

REMARKS

Claims 1, 2, 4, and 5 will be in this application after entry of the above set of claims.

Claims 1 and 4 have been amended.

The drawing corrections requested by the Draftsperson will be submitted once the claims have been found in condition for allowance.

Claim 4 has been objected to for being dependent from cancelled Claim 3. Claim 4 has been amended to overcome the Examiner's objection by changing the dependency.

The Applicant's invention relates to the use of external foils having a rough exposed surface to make possible the drilling of vias with a carbon dioxide laser. As explained at page 4, lines 1-5, it has been necessary to etch away an area on the surface of external copper foils to expose the resin when using a carbon dioxide laser. As shown in Figure 3, the roughness of the foil is important to reduce reflecting of the laser which makes possible drilling of vias without first removing copper from the area to be drilled. The optimum roughness is shown to be about 10 to 20 μ m R_z, but a wider range is possible, which has been included in Claim 1.

Claims 1 and 4 have been rejected under 35 USC 103(a) as unpatentable (i.e. obvious) over Shin et al (Shin) in view of Taneda et al (Taneda), further in view of Yates et al (Yates). Shin was cited for a process of making a multi-layer printed wiring board, but failed to teach the use of a carbon dioxide laser. Taneda was cited for teaching that both YAG and carbon dioxide lasers can be used to make via holes. Yates was cited for forming a waved copper foil having a surface roughness of about 3-8 microns for improving bonding to a resin substrate. While Yates did not teach the roughness of the present invention, the Examiner contended that optimization

was obvious to one skilled in the art. These references are not sufficient individually and in combination to make the present invention obvious.

Shin was cited for a process of making a multilayer printed wiring board including, forming a via hole with a laser, plating the resulting laminate to form an interlayer connection, applying an etch resist, and forming a circuit pattern. As the Examiner noted, Shin teaches the use of a YAG laser, not a carbon dioxide laser. As the Applicant's stated in the paragraph beginning at line 20 on page 4, YAG lasers can be used to make via holes, but carbon dioxide lasers present problems to makers of multilayer printed wiring boards. Thus, the interchangeability of YAG and carbon dioxide lasers suggested by Taneda is not pertinent to the present invention, since it does not recognize that drilling with a carbon dioxide laser can successfully be done when the surface has a roughness within a particular range of R_z values. As shown in Figure 3, and discussed at pages 9-12, there is a range of surface roughness in which reflectivity is reduced and within which the carbon dioxide laser drilling is facilitated. More importantly, Taneda teaches that a hole is cut in the copper foil layer to expose the resin underneath before drilling via holes (see Claim 1 and column 6, lines 24-26). Thus, Taneda does not recognize the problem addressed by the Applicants, but actually uses the older method mentioned in the present application at page 4, lines 1-5.

Yates discloses a method of smoothing the roughness of the matte side of copper foil by depositing particles in the valleys. The present invention includes no such method. Yates' objective was to make a uniform roughness having an R_z value of 3-8. There is no suggestion that the exposed side would have a roughness such that it could be drilled with a carbon dioxide laser. Therefore, there is no reason to combine Yates with Shin and Taneda.

Claim 2 has been rejected under 35 USC 103(a) as unpatentable over Shin in view of Taneda and Yates and further in view of Ando et al (Ando), who is cited for the use of rust prevention layers. Claim 2 depends from Claim 1. If Claim 1 is patentable, as argued above, then Claim 2 should also be patentable, since Ando does not overcome the deficiencies of the principal references.

Claim 5 has been rejected under 35 USC 103(a) as unpatentable over Shin in view of Taneda and Yates, further in view of Kataoka et al (Kataoka), who is cited for the use of a carrier foil and improved laser drilling. As with Claim 2, Claim 5 is dependent from Claim 1 and should be allowable if the Examiner agrees that Claim 1 is patentable. It is noted that Kataoka teaches the application of a layer of particles that facilitates laser drilling (see paragraph 0067). In the present invention, the layer exposed to laser drilling is an electrodeposited foil, not a layer of particles.

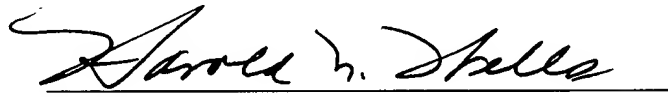
In view of the proposed amendments and the above discussion showing the cited references to be lacking, the Examiner is asked to enter and allow the amended claims. If further amendment is believed to be needed, the Examiner is invited to contact the Applicant's attorney at the telephone number provided below.

Conclusion

It is believed that no fee is presently due; however, should any additional fees be required (except for payment of the issue fee), the Commissioner is authorized to deduct the fees from Jenkins & Gilchrist, P.C. Deposit Account No. 10-0447, Order No. 47163-00037.

Respectfully submitted,

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